



## Original communication

## Focussing on the future: Survey results on the image capture of patterned cutaneous injuries



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## ABSTRACT

An investigator who is involved in assessing the likelihood of physical abuse must make a decision as to whether the injury seen matches the explanation given. In some instances the pattern of these injuries can give the investigator a possible link to the cause of the injury. Photographic imaging is used to record the patterned cutaneous injuries (PCI) and to facilitate forensic interpretation. The current method of capturing PCI often results in some form of distortion that causes a change to the shape of the patterned injury. The Dermatological Patterned Injury Capture and Analysis (DePICA) research group was formed to assess current image capture methods and practices. An online survey was set up to assess the value of localised imaging protocols and training specific to imaging PCI and was made available to law enforcement professionals, forensic investigators and hospital staff. 80 participants responded to the survey. The majority of the survey participants have had training in medical or forensic photography, however 66 (83%) have not had specific training in how to photograph PCI. 41 (51%) of the participants responded that they always use a rigid scale and 34 (43%) position the camera so that it is perpendicular to the scale and injury. Comments made about the quality of images obtained and produced raises concerns about how much knowledge those initiating such images have about image relevance in criminal cases. It is evident that a clear and comprehensive guide to photographing PCIs is required to improve the quality of the photographic evidence that is collected.

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## 1. Introduction

The Dermatological Patterned Injury Capture and Analysis (DePICA) research group, comprises multi-professional collaborators from a wide range of backgrounds, including the Metropolitan Police Service (MPS), the Home Office Centre for Applied Science

and Technology (CAST), the National Injuries Database at the National Crime Agency (NCA), Barts and the London School of Medicine and Dentistry, Expert Forensics Ltd, and Cardiff University Schools of Medicine, Dentistry, and Mathematics. It was formed in March 2011 funded by the Children and Young Person Research Network (CYPRN)<sup>1</sup> The DePICA has two main research aims: 1) to assess current image capture methods and practices and 2) to produce guidelines for best practice. This paper addresses the first aim.

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Patterned cutaneous injuries (PCI), such as bruises, bite marks, and other visible marks on the skin, usually occur when the body has been damaged by external trauma. Many factors influence whether trauma leaves marks of injury or long-term marks or scars. In cases where these injuries are intentional or there is the possibility that they are non-accidental, appropriate recording for evidential purposes may be crucial in subsequent court cases. When such injuries are patterned, they may have features or configurations that may be indicative of the implement used, or the physical contact surface of a perpetrator. Such patterns are not always recognisable at the time of the initial investigation, and subsequent information about the nature of implement and causation may then corroborate evidence or reveal the true cause.

Good quality images can capture the appearance of an injury and can be used for evidential purposes<sup>2–4</sup> to facilitate discussion of the injury in audit and peer review, strategy and case conference meetings, and within the court setting. In addition, recording the accurate shape, size, colour, and position of a patterned injury can be of forensic significance<sup>5–12</sup> and may enable comparison of the pattern of the injury to the contact surface shape of the implement. The outcome of this analysis, in terms of admissibility as evidence, can depend upon how well these patterns are reproduced with digital photography. Factors such as lens and angular distortion, sharpness of focus, exposure, contrast, colour representation and digital artefacts can all affect the standard of image quality and may not be recognized by some of those working within a forensic setting.<sup>13,14</sup>

Guidelines for the imaging of bite marks have been made available by the British Association of Forensic Odontology (BAFO) and the American Board of Forensic Odontology (ABFO),<sup>15,16</sup> and image capture literature has previously been produced by National Policing Improvement Agency (NPIA) the Home Office, and the Federal Bureau of Investigation (FBI).<sup>17–19</sup> However, at the time of writing, we are not aware of any published protocols specific to the imaging of PCI pertaining to inflicted or non-accidental injury.

A recent study has shown that many images of PCI that are taken for both documentation and forensic purposes are of inadequate quality to yield successful forensic analysis results.<sup>20</sup> Problems may relate (amongst others) to poor focus, poor lighting, poor framing and lack of rulers or colour scales. This is largely due to the range of image capture techniques used, the range of individuals taking the images and the lack of any standardised imaging protocols.

The aim of this study was to document the current imaging practice of PCI, by taking a broad range of practitioners involved in such work including professional (forensic and medical photographers) and non-professional photographers (crime scene officers (CSOs), medical and forensic practitioners).

## 2. Methods

An online survey was created to assess the value of localised imaging protocols, training specific to imaging PCI the current procedures used by photographers and the consequent standard of images produced. In addition, the participants' knowledge of image quality and its importance in terms of documentation and potential forensic analysis were also evaluated.

The survey was aimed at a broad sample medical and forensic practitioners who regularly partake in the photography of injuries (capture and/or viewing of images). The survey questions were compiled by consensus by the members of the DePICA collaborative research group. It was deemed important that the survey should be concise quick and easy to answer direct questions. It included closed multiple-choice questions with the option to comment to maximise information capture. Specific questions were directed at respondents who review images within their professional practice and others at photographers themselves.

The survey was built using Google Documents and was disseminated electronically over a ten week time period (February 23rd–May 7th 2012) to Scientific Support Managers (SSMs), Forensic Practitioners, and Child Abuse Investigators across the UK. A reminder to complete the survey was sent in April 2012. The survey link was made available to potential responders via specialist web-sites, Child protection communities, the Institute of Medical Illustrators group and distributed to members of the Royal College of Paediatrics and Child Health (RCPCH) in their monthly college e-bulletin.

The results from the completed surveys were downloaded into Microsoft Office Excel and PASW Statistics v18 for analysis. The raw data compiled in Google Documents is available online on contact with the corresponding author. The percentages are rounded up to the nearest whole number.

## 3. Results

A total of 80 survey questionnaires were completed and analysed.

Table 1 shows that  $n = 69$  (86%) respondents considered photography essential when investigating a cutaneous injury suspicious of abuse. A further  $n = 10$  (13%) stated it was worthwhile.

$n = 76$  (95%) of respondents stated that they were, or had access to, a professional photographer or camera competent officer. Of these,  $n = 57$  (71%) stated that there are occasions when a professional photographer is not available. Appendix 1 gives some examples of such reasons of which 'staffing issues or 'no out-of-hours service' were most common. Some selected comments from Appendix 1:

### 3.1. Reasons given for non-use, non-availability of photographer

#### 3.1.1. Respondent – POLICE PHOTOGRAPHER

"We have 24/7 availability of CSI's and Photographers, it is not unusual for officers to photograph injuries using camera phones... quality is poor and close-up photography is generally blurred with little definition. At some Senior Officer level, there is a belief that everyone carries a camera on their phone and so why do we need more expensive cameras and a professional behind it !"

#### 3.1.2. Respondent – CRIME SCENE OFFICER

"Not used because untrained constables with a point-and-shoot camera think their blurry efforts are sufficient."

#### 3.1.3. Respondent – REGISTERED MEDICAL PRACTITIONER

"The hospital team work 9-5 M-F. Police photography will only be used in cases of severe injury. Therefore, minor injuries which may be possibly abuse that come to hospital on week end will not be photographed until Monday, by which time appearances may have changed. Hospital staff are advised not to photograph injuries themselves".

**Table 1**

The relevance and frequency of photographing Patterned Cutaneous Injuries (PCI).

"When an individual has an injury, and physical abuse is suspected, how do you consider photography?"	Essential	69 (86%)
	Worthwhile	10 (13%)
	No preference	1 (1%)
	Unnecessary	0 (0%)
	Undesirable	0 (0%)
How often do you photograph visible injuries in suspected physical abuse	Always	40 (50%)
	Usually	35 (44%)
	Sometimes	4 (5%)
	Rarely	1 (1%)
	Never	0 (0%)

### 3.1.4. Respondent – FORENSIC PRACTITIONER/ODONTOLOGIST

"I do not take the images and am usually consulted AFTER photos have been taken (good or bad). If contacted at an early stage I give advice about the photography."

### 3.1.5. Respondent – HOSPITAL BASED MEDICAL PHOTOGRAPHER

"Out of hours admissions are not photographed professionally as we do not work on call. When staff are otherwise engaged and are not available because staffing levels are too low. Sometimes complacent nursing/healthcare staff simply do not request photography or will use their department's own point and shoot – to the detriment of the images."

Considering the question, "When images are captured, who does the photography?" and rating the frequency when the different professions may take the photographs with Always, Usually, Sometimes, Rarely and Never. Table 2 demonstrates the results.

Table 3 shows the responses to a series of questions regarding technical knowledge. One third of the survey respondents were hospital-based or police photographers.

$n = 52$  (65%) have received training in medical or forensic photography, but  $n = 66$  (83%) have not received specific training in how to photograph PCI.  $n = 55$  (69%) of the respondents were unaware of any guide specific to PCI.

A Digital Single Lens Reflex (DSLR) is most commonly used imaging device,  $n = 51$  (64%). A compact camera was used by  $n = 12$  (15%) respondents and mobile phones were employed by  $n = 2$  (3%) of those who completed the survey. Other devices were employed by  $n = 15$  (19%).

Storage of images was variable.  $N = 38$  (48%) utilised a hard copy in patients' notes whilst  $n = 34$  (43%) accessed a hospital database based in medical photography. Other forms of storage included; digital image stored in medical records  $n = 19$  (24%); police database archive  $n = 18$  (23%); other  $n = 18$  (23%). Some respondents used more than one storage method.

With regard to bite mark photography BAFO advise that the forensic odontologist is present when photography is undertaken,<sup>15</sup>

**Table 2**

Responses regarding who takes the photographs.

"A medical photographer would take the photographs"	Always	11 (14%)
	Usually	28 (35%)
	Sometimes	19 (24%)
	Rarely	11 (14%)
	Never	11 (14%)
"A Police photographer would take the photographs"	Always	3 (4%)
	Usually	16 (30%)
	Sometimes	29 (36%)
	Rarely	16 (20%)
	Never	16 (20%)
"A Crime Scene Officer would take the photographs"	Always	11 (14%)
	Usually	11 (14%)
	Sometimes	19 (24%)
	Rarely	12 (15%)
	Never	27 (34%)
"A Medical practitioner would take the photographs"	Always	1 (1%)
	Usually	1 (1%)
	Sometimes	26 (33%)
	Rarely	22 (28%)
	Never	30 (38%)
"A Forensic practitioner would take the photographs"	Always	1 (1%)
	Usually	1 (1%)
	Sometimes	12 (15%)
	Rarely	21 (26%)
	Never	45 (56%)
"A Nurse would take the photographs"	Always	0 (0%)
	Usually	0 (0%)
	Sometimes	16 (20%)
	Rarely	8 (10%)
	Never	56 (70%)

**Table 3**

Responses regarding technical knowledge.

"Are you physically present when photography is undertaken?"	Always	18 (23%)
	Usually	26 (33%)
	Sometimes	18 (23%)
	Rarely	9 (11%)
	Never	9 (11%)
"Do you include a rigid linear scale within your image?"	Always	41 (51%)
	Usually	13 (16%)
	Sometimes	7 (9%)
	Rarely	1 (1%)
	Never	4 (5%)
"If a scale is used, is it positioned so that it is perpendicular to the camera?"	Always	34 (43%)
	Usually	18 (23%)
	Sometimes	9 (11%)
	Rarely	0 (0%)
	Never	1 (1%)
"Do you include a flexible metric scale within your image?"	Always	3 (4%)
	Usually	1 (1%)
	Sometimes	22 (28%)
	Rarely	16 (20%)
	Never	24 (30%)
"How do you rate the following aspects of the image when considering the quality of evidence gathered?" – A rigid linear metric scale was captured within the image	Essential	54 (68%)
	Worthwhile	19 (24%)
	No preference	4 (5%)
	Unnecessary	0 (0%)
	Undesirable	3 (4%)
"How do you rate the following aspects of the image when considering the quality of evidence gathered?" – The camera was held perpendicular to the injury and the scale.	Essential	58 (73%)
	Worthwhile	12 (15%)
	No preference	9 (11%)
	Unnecessary	0 (0%)
	Undesirable	1 (1%)
"How do you rate the following aspects of the image when considering the quality of evidence gathered?" – A flexible metric scale was captured within the image	Essential	13 (16%)
	Worthwhile	26 (33%)
	No preference	19 (24%)
	Unnecessary	5 (6%)
	Undesirable	17 (21%)

results show that this is not achieved with only  $n = 26$  (33%) reporting that the odontologist is 'Usually' present. Just over half confirmed that they always use a rigid scale  $n = 41$  (51%) whilst  $n = 34$  (43%) always position the camera perpendicular to the scale and thus the injury. The majority  $n = 54$  (68%) of those that perform the analyses considered it essential to use a rigid scale and have the camera perpendicular to the scale  $n = 58$  (73%).

Respondents were asked to rate the use of other imaging modalities such as Cross-Polarised (CP), Infrared (IR) and Ultra violet (UV) and other techniques employed. These responses are shown in Table 4.

The majority of the respondents  $n = 52$  (65%) said they never use a cross polarised technique. However  $n = 71$  (89%) found it undesirable to have glare from the flash in the image, which would be eradicated by cross polarisation. The majority of the respondents do not use IR & UV. The majority of the respondents  $n = 64$  (80%) were aware of the importance of taking images at different angles when dealing with injuries on a curved surface.

Table 5 shows the responses to questions regarding implements and causation.

The nature of responses shown in Table 5 varies according to the professional background of the respondent. For example; 19 out of 20 of the medical photographers (which would not often be asked) responded with Never. However, 9 out of 11 of the forensic practitioners (including forensic odontologists) assert that they are always required to comment on such matters.

Medical practitioners (the largest single respondent group) make up  $n = 24$  (30%) of the respondents, of which  $n = 10$  (42%) are always required to comment with  $n = 6$  (25%) either usually or sometimes required to comment and  $n = 2$  (8%) are never required.

**Table 4**  
Use of other imaging modalities and techniques.

“Do you ever use... cross polarised”	Always	0 (0%)
	Usually	0 (0%)
	Sometimes	9 (11%)
	Rarely	5 (6%)
	Never	52 (65%)
“Do you ever use... Infrared”	Always	0 (0%)
	Usually	0 (0%)
	Sometimes	6 (8%)
	Rarely	8 (10%)
	Never	52 (65%)
Do you ever use... Ultra violet”	Always	1 (1%)
	Usually	0 (0%)
	Sometimes	13 (16%)
	Rarely	14 (18%)
	Never	38 (48%)
“How do you rate the following aspects of the image when considering the quality of the evidence gathered? – More than one imaging modality is used to capture the injury?”	Essential	5 (6%)
	Worthwhile	31 (39%)
	No preference	37 (46%)
	Unnecessary	6 (8%)
	Undesirable	1 (1%)
“..... There is glare from the flash within the image?” (Specular highlights)	Essential	2 (3%)
	Worthwhile	1 (1%)
	No preference	4 (5%)
	Unnecessary	2 (3%)
	Undesirable	71 (89%)
“..... Multiple images if an injury is on a curved surface?”	Essential	64 (80%)
	Worthwhile	12 (15%)
	No preference	3 (4%)
	Unnecessary	0 (0%)
	Undesirable	1 (1%)
“..... That the whole extent of the injury is captured within the image?”	Essential	64 (80%)
	Worthwhile	12 (15%)
	No preference	3 (4%)
	Unnecessary	0 (0%)
	Undesirable	1 (1%)
“Do you use a colour chart within your images?”	Always	2 (3%)
	Usually	2 (3%)
	Sometimes	5 (6%)
	Rarely	9 (11%)
	Never	48 (60%)
“Do you obtain written consent for the images taken?”	Always	39 (49%)
	Usually	11 (14%)
	Sometimes	8 (10%)
	Rarely	8 (10%)
	Never	14 (18%)

#### 4. Discussion

The objective of this study was to document the current imaging practice of PCI, by taking a broad range of practitioners involved in such work both including professional (forensic and medical photographers) and non-professional photographers (crime scene officers (CSOs), medical and forensic practitioners).

**Table 5**  
Regarding implements and causation.

“How often is the suspected implement of the injury available to you or the investigative team?”* 15 (19%) Did not answer.	Always	0 (0%)
	Usually	9 (11%)
	Sometimes	20 (25%)
	Rarely	20 (25%)
	Never	16 (20%)
“If available, do you photograph the suspected implement?”* 30 (37%) Did not answer.	Always	20 (25%)
	Usually	11 (14%)
	Sometimes	9 (11%)
	Rarely	8 (10%)
	Never	2 (3%)
“In your work, are you required to comment upon the possible causation of the injury?”	Always	22 (28%)
	Usually	8 (10%)
	Sometimes	11 (14%)
	Rarely	5 (6%)
	Never	34 (43%)

There are limitations in the study such as not getting survey responses from every practitioner within the group. One could also argue that not all relevant professional groups may have been included in the survey and therefore the data is not a good representation of the current practices. Furthermore, the study did not correlate responses with experience or training. However the range of responses from across the UK suggests a more basic concern is that a substantial proportion of respondents have little or no specific knowledge or training in imaging of PCI.

This study, though relatively small, has confirmed what was previously perceived, that there is no consistent standard or training or background when image taking of PCI is considered. This is consistent with a previous study, which showed the poor quality of imaging in similar settings.<sup>20</sup> The reasons are not clear, but must in part be due to a) lack of standardised guidelines for imaging of PCI and b) variability in approaches, funding and protocols.

The authors are not aware of any previous similar studies into these matters and it is hoped that the results obtained will provide a base to guide further research, perhaps targeting single groups of practitioners who have not specifically been included (e.g. forensic physicians, forensic nurses, emergency medicine specialists). The data show that a number of the survey participants have had training in medical or forensic photography but half of those were not professional photographers. A significant portion of the 80 participants have not had specific training in how to photograph patterned cutaneous injuries and most were not aware of BAFO published guidelines into the imaging of such injuries.<sup>15</sup> This lack of training is confirmed by the fact that only half of the participants responded that they always use a rigid scale and less than half position the camera so that it is perpendicular to the scale and injury. It is well recognised by trained individuals that both of these actions are essential to ensure that patterned injuries of any kind are photographed without any distortions. It is of great concern that only half of the respondents always obtain written consent for photography with  $n = 14$  (18%) never obtaining written consent. This is contrary to clearly established guidance by a variety of professional bodies including the General Medical Council,<sup>21</sup> the Institute of Medical Illustrators<sup>22</sup> and The Police and Criminal Evidence Act 1984.<sup>23</sup>

In regards to techniques applied, more than half never use colour charts when photographing PCI and more than half have never seen a colour chart in the images they have examined. Guidelines have suggested that it is valuable to have a colour chart in the image.<sup>24</sup> In practice, a colour chart should be used in every image as photographic variables, including aperture, distance from flash to object and other images modalities such as cross polarised, can all influence the colour representation in the image. Colour of lesions may influence the practitioner's interpretation, for example with regard to nature and ageing of injury especially with bruising (It should be noted that a bruise cannot accurately be aged by photography).<sup>25</sup> The majority of the participants have never used other image modalities (CP,UV & IR), which is likely to be a reflection on the availability, utility and knowledge of the technology.

Positive aspects of the study are that some of the participants have had the required training and most have applied logical reasoning at least in regards to some aspects of photographing the injury.  $n = 64$  (80%) stated that it is essential that multiple images be taken if the injury is on a curved surface.  $n = 64$  (80%) stated that it is essential that the whole extent of the injury be photographed.

The comments made about how good quality professional images are obtained and produced raises concerns about how much knowledge those funding or initiating such images have about image relevance in criminal cases. Those funding departments of imaging and those responsible for producing copies for review in court cases, rarely appear to have any concept of the key



importance for evidential purposes of good quality images. Good quality images may be crucial in either disproving or proving facts. Images that are of poor quality when reviewed by experts within criminal cases will be excluded rapidly as worthless or misleading. The use of smartphones or other cameras in inexperienced hands has the potential for a) failing to convict the guilty, or conversely, b) causing miscarriages of justice.

It is essential that improvements in practice are made so that the quality of photographic evidence, (not least in the use of rigid rules and colour scales and the correct position of the camera relative to the scale and the injury) is optimised. Further research work needs to be done to highlight the possible benefits of cross polarised imaging to reduced specular highlights and possible access to implements to photograph for comparison with the injury (where possible).

## 5. Conclusion

This study has confirmed a wide range of practice and practitioners working in the field of imaging for PCI. The range of responses has shown some substantial gaps in practice and knowledge. It is important that those taking images understand why they are being taken, and liaise with those who will be interpreting such images in court. There are issues regarding staffing for out of hours cover and coupled with the inability for those that perform the interpretation of images to always be present at the time of photography, it is evident that a clear and comprehensive guide to photographing PCIs is required. Such a guide will improve the quality and provide standards for the photographic evidence that is collected. Further work needs to be done to highlight the importance of following a protocol to achieve quality PCI images with greatly reduced photographic distortion to aid any forensic analysis that needs to be performed such as metric analysis or comparing the pattern of the injury to the pattern of the striking edge of the suspected implement using the technique of image overlay or digital superimposition. It is the intention of DePICA to develop guidelines to photographing PCIs, which will help facilitate capture of images that are suitable for forensic analysis. It is important to note that any mention of a technical guide or recommendation on equipment is not seen as a replacement to experienced personnel.

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## Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.jflm.2014.02.007>.

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